Firewall Configuration for Linux Administrators

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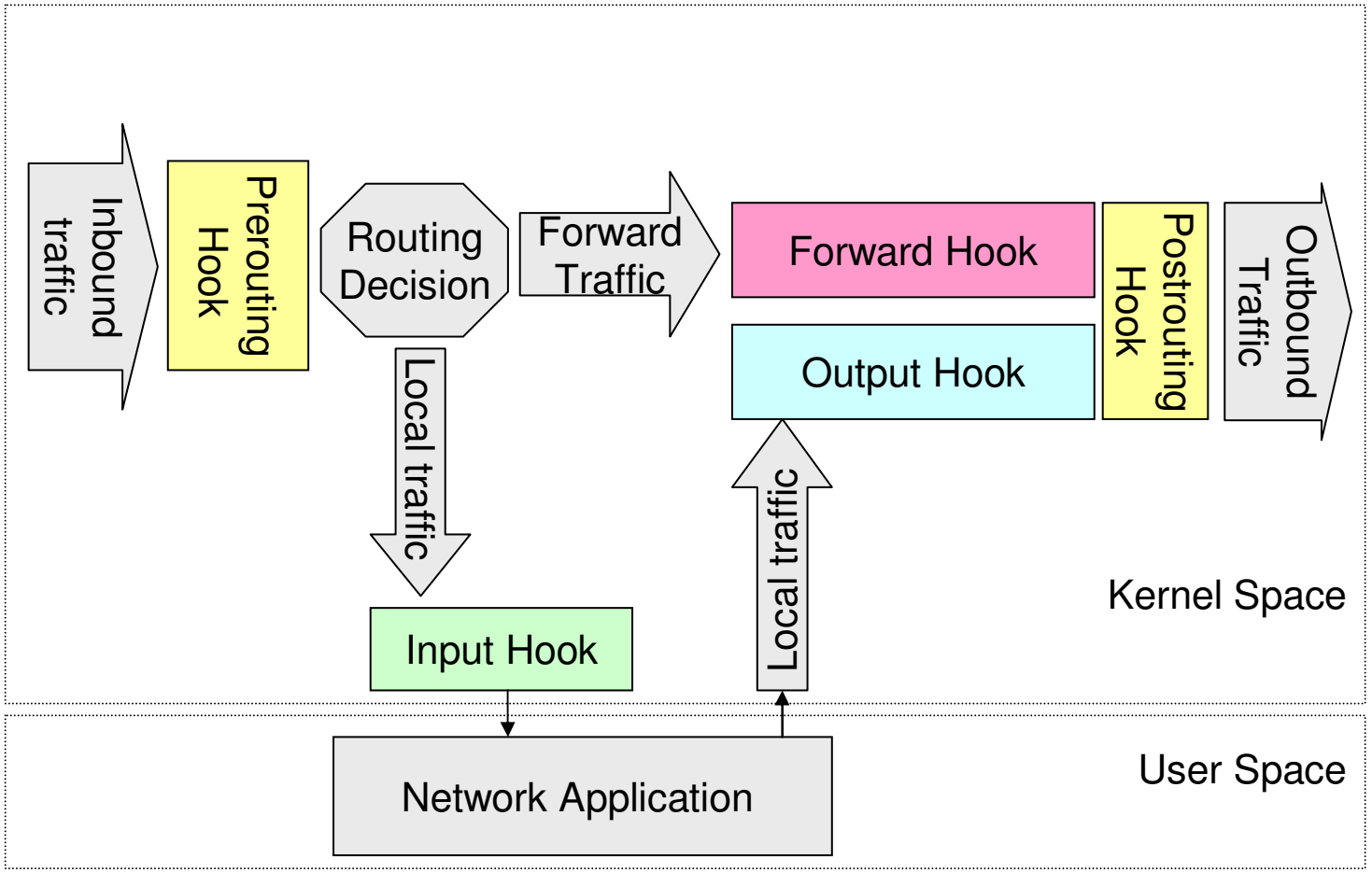
Firewall Configuration for Linux Administrators

- Review of netfilter/iptables
- Preventing Common Attacks
- Auxiliary Security Programs
- Extended Features
- Management Tools

Review of netfilter/iptables

- kernel structure
- Linux firewall alternatives
- Syntax example

netfilter kernel structure



Linux firewall alternatives

Firewall	Kernel Version	Packet Filtering	NAT	Connection tracking/ Stateful inspection	Application Intelligence	Integrated VPN Capability	Integrated QOS Marking
ipfwadm	1.0	X	X				
ipchains	2.2.0	X	X			X	X
netfilter/iptables	2.4.0	X	X	X	Partial	X	X
Firewall-1	2.4.0	X	X	X	X	X	X

Syntax example

```
#!/bin/sh

set -e
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin
PATH=$PATH:/usr/sbin:/usr/bin

INET_IF=eth0
LAN_IF=eth1

block_all()
{
#install kernel modules
modprobe ip_conntrack
modprobe ip_conntrack_ftp

# disable forwarding
echo 0 > /proc/sys/net/ipv4/ip_forward

# flush any existing rules
iptables -F
iptables --table nat --flush
iptables --delete-chain
iptables --table nat --delete-chain

# set the default policy to be DROP
iptables -P INPUT DROP
iptables -P OUTPUT DROP
iptables -P FORWARD DROP
}

case "$1" in
  start)
# set firewall to initial (secure) state
block_all

# enable loopback interface
iptables -A INPUT -i lo -p all -j ACCEPT
iptables -A OUTPUT -o lo -p all -j ACCEPT


# enable dhcp on the internet interface
iptables -A INPUT -p UDP -i $INET_IF \
--sport 67 --dport 68 -j ACCEPT
iptables -A OUTPUT -p UDP -o $INET_IF \
--dport 67 --sport 68 -j ACCEPT


# allow forwarding packets for open connections
iptables -I FORWARD -m state \
--state INVALID -j DROP
iptables -I FORWARD -m state \
--state RELATED,ESTABLISHED -j ACCEPT

# allow outbound connections from LAN
iptables -A FORWARD --in-interface $LAN_IF \
-j ACCEPT

# set up NAT to masquerade protected network
iptables --table nat --append POSTROUTING \
--out-interface $INET_IF -j MASQUERADE

# allow web and ftp traffic to the firewall

iptables -A INPUT -i $INET_IF -p tcp \
--destination-port ftp -j ACCEPT
iptables -A INPUT -i $INET_IF -p tcp \
--destination-port ftp-data -j ACCEPT
iptables -A INPUT -i $INET_IF -p tcp \
--destination-port www -j ACCEPT

# allow all service related outbound traffic
iptables -A OUTPUT -o $INET_IF -p tcp \
--source-port ftp -j ACCEPT
iptables -A OUTPUT -o $INET_IF -p tcp \
--source-port ftp-data -j ACCEPT
iptables -A OUTPUT -o $INET_IF -p tcp \
--source-port www -j ACCEPT

# allow protected hosts full access to fw
iptables -A INPUT -i $LAN_IF -j ACCEPT
iptables -A OUTPUT -o $LAN_IF -j ACCEPT

#log dropped packets
iptables -A INPUT -m limit -j LOG

# enable forwarding
echo 1 > /proc/sys/net/ipv4/ip_forward

   ;;
  stop)
                    #return firewall to initial (secure) state
                    block_all
   ;;
  *) exit
;;
esac
```

Preventing Common Attacks

- Attacks that Firewalls defend against
  - Spoofed Packets
  - Source Routed Traffic
  - DoS attacks (some protection)
  - Port Scanning

Spoofed Packets

- Block spoofed packets to prevent SMURF attacks, Redirect attacks and other bad things
- Linux Protection:
  - The kernel can be configured to drop packets whose source address doesn't route to the inbound interface. (per interface)

```
echo 1 > /proc/sys/net/ipv4/conf/${DEVICE}/rp_filter
echo 1 > /proc/sys/net/ipv4/icmp_echo_ignore_broadcasts
```

  - Firewall rules can enforce good behavior from internal hosts

```
iptables -A FORWARD -i ${INET_DEV} -s ${NETWORK} -j DROP
Note:   INET_DEV = internet interface
        NETWORK = n.n.n.n/n -- protected network
```

Source Routed Traffic

- Source routing allows attackers to deliver spoofed packets into a protected network
- Linux Protection:
  - The kernel can be configured to drop source routed packets (per interface)
  - Syntax:

```
echo 0 > /proc/sys/net/ipv4/conf/${DEVICE}/accept_source_rout
```

DoS attacks

- Cannot be prevented
- Can prevent DoS effects from reaching into the protected network
- Can block spoofed packets to avoid being the intermediary or originator of a DoS attack

  (See Previous Slide)
- Linux Protection:
  - Firewall can rate-limit inbound traffic

```
iptables -A INPUT -p TCP --syn -m limit --limit 5/second -j ACCEPT
iptables -A INPUT -j DROP
```

Port Scanning

- Attackers use port scans to probe the firewall/protected network for vulnerabilities
- Linux protection:
  - PSAD: Port Scan Attack Detector can be configured to sniff firewall logs and report on intrusion fingerprints. Reporting can include automatically blocking attacker addresses, although there are issues with this.
  - In order for psad to work, the firewall should be configured to log all dropped traffic (subject to rate limiting of course)
  - http://www.cipherdyne.org/psad/manpage.html

Auxiliary Security Programs

- VPN
- NAT Masquerade
- Proxy Filtering
- Virus Scanning

Integrated VPN

- VPNs secure communication on a public network
- Linux solution:
  - FreeS/WAN is a GPL IPSec VPN that can be run on the firewall machine to terminate IPSec tunnels into the protected network.
  - IPSec client side tunnel support can be configured for many hosts (even Windoze)
  - http://www.freeswan.org/freeswan_trees/freeswan-2.04/doc/config.html

Integrated NAT

- Dynamic Network Address Translation (masquerading) makes it difficult for attackers to access protected hosts
- Linux Solution:
  - netfilter/iptables has support for NAT built in

```
iptables -t nat -A POSTROUTING -s ${NETWORK} -o ${DEVICE} -j MASQUERAD
```

Proxy Filtering

- Proxy filtering provides application level security
- Linux Solution:
  - squid web proxy running on the firewall (or protected machine)
  - iptables rules to enforce traffic only flows through the proxy server
  - http://www.squid-cache.org/

Virus Scanning

- A virus scan integrated with sendmail or other MTA protects the network by detecting and removing viruses in individual users' email traffic
- Linux Solution:
  - Many free and commercial options.
  - Largest is www.centralcommand.com

Extended Features

- Load-Balancing
- Modifying TOS
- QOS Queuing
- Policy Routing

Load Balancing

- Using load balancing, we can balance traffic among a number of parallel servers
- Linux Solution:
  - Combined SNAT and DNAT rules to redirect packets to a bank of servers

```
iptables -t nat -A POSTROUTING -o ${DEVICE} -j SNAT --to
   205.159.243.241
iptables -t nat -A PREROUTING -d ${ADDRESS} -p TCP --dport
   http -j DNAT --to-dest 10.0.0.2-10.0.0.8
```

Modifying TOS

- Type of Service on packets can be modified to produce improved performance for selected packets (although most routers ignore these bits)
- Linux Solution:
  - Packet mangling with iptables

TOS VALUES:

Minimize-Delay 16 (0x10)
Maximize-Throughput 8 (0x08)
Maximize-Reliability 4 (0x04)
Minimize-Cost 2 (0x02)
Normal-Service 0 (0x00)

Mangling Example:

```
iptables -A PREROUTING -t MANGLE -p TCP --sport telnet -j TOS --set-tos 16
```

QOS queuing

QOS queuing allows the administrator to prioritize or shape network traffic with more flexibility than the TOS field supports.

Linux support:

- netfilter/iptables for marking packets

```
iptables -A PREROUTING -i ${DEVICE} -t mangle -p tcp --sport telnet -j MARK --set-mark 1
```

- tc for assigning marked packets various queue

```
tc qdisc add dev ${DEVICE} handle ffff: ingress
tc filter add dev ${DEVICE} parent ffff: protocol ip prio 50 handle 1 fw police rate 1kbit burst 40 mtu 
    drop flowid :1
```

- http://lartc.org/ has a full description of setting up QOS shaping

Policy Routing

Policy Routing assigns alternate routes to packets based on more than destination address lookup

Linux support:

- netfilter/iptables for marking packets

```
iptables -A PREROUTING -i ${DEVICE} -t mangle -p tcp --sport telnet
   -j MARK --set-mark 1
```

- iproute2 for enforcing policy routing

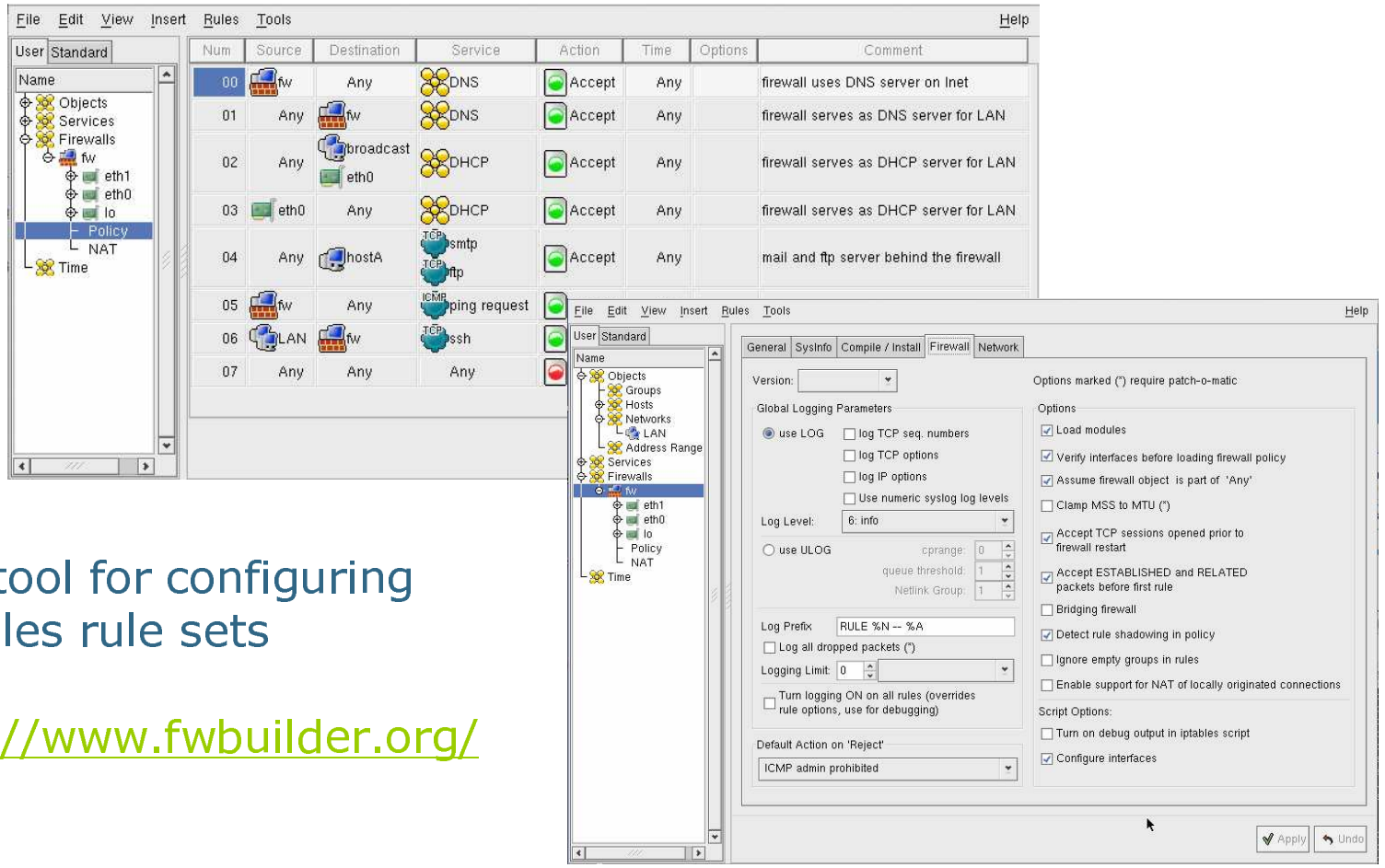
```
echo 201 telnet >> /etc/iproute2/rt_tables
ip rule add fwmark 1 table telnet
/sbin/ip route add default via ${FAST_NEXTHOP} dev ${FAST_DEVICE} table
   telnet
```

- http://lartc.org/ describes iproute2 in detail

Management Tools

- fwbuilder
- ipmenu
- IPTables Log Analyzer

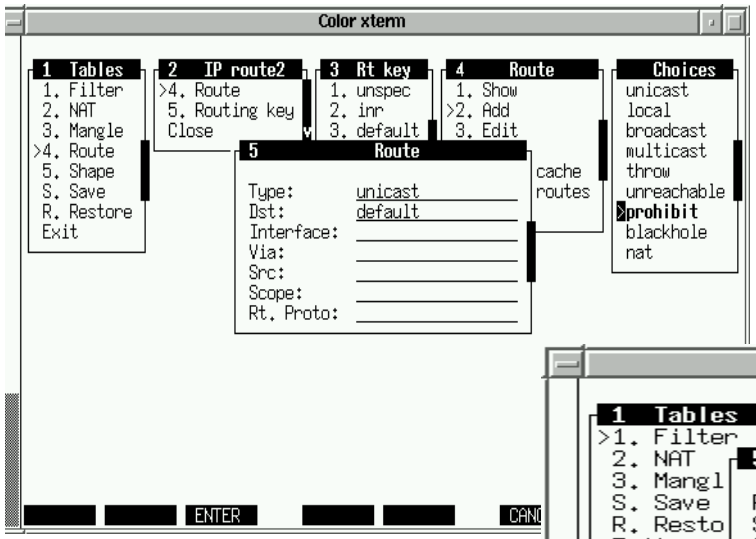
fwbuilder



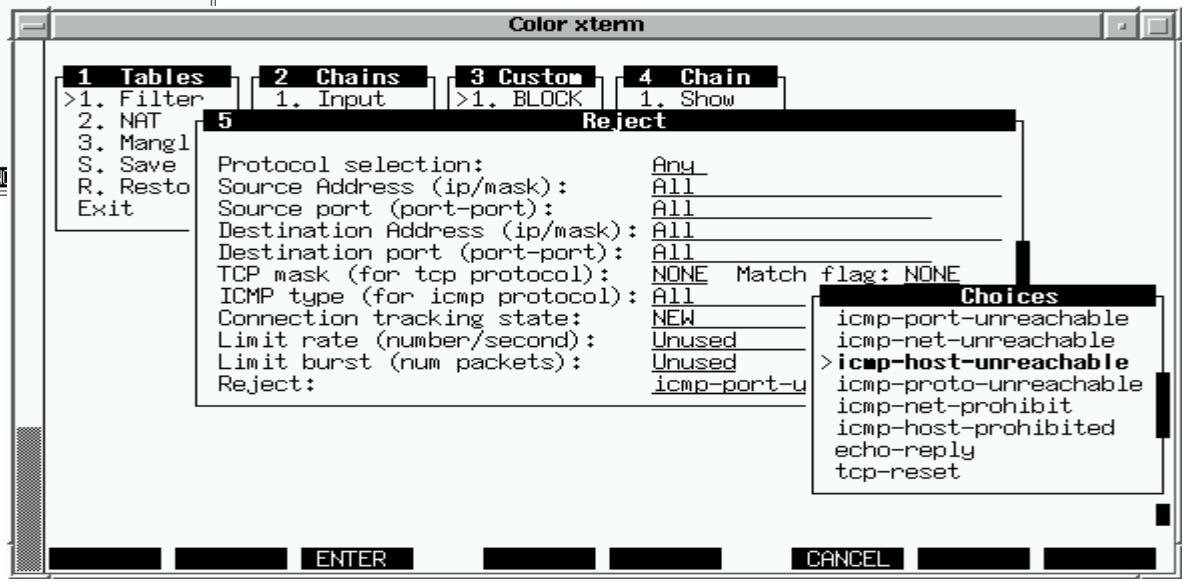
GUI tool for configuring iptables rule sets

http://www.fwbuilder.org/

ipmenu

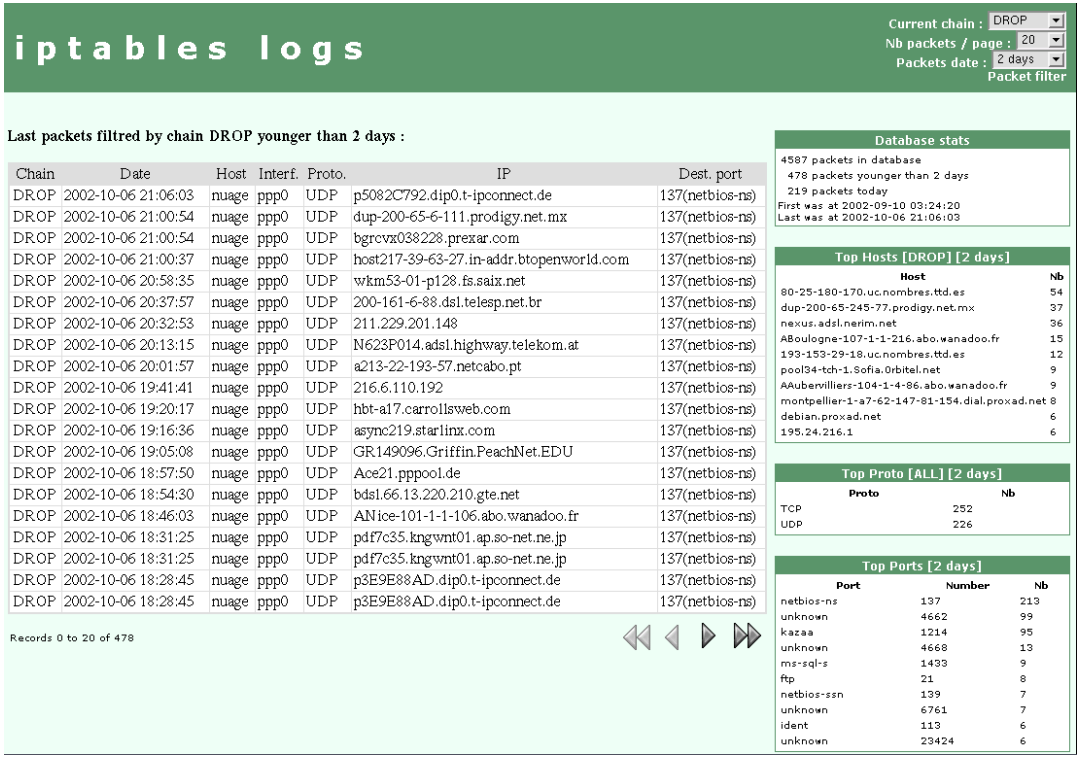


ASCII (curses) UI tool for configuring iptables rule sets
Also generates policy routing and QOS configuration
http://users.pandora.be/stes/ipmenu.html



IPTables Log Analyzer

- Log file analyzer (to HTML)
- http://www.gege.org/iptables/



iptables logs

Current chain : DROP
Nb packets / page : 20
Packets date : 2 days
Packet filter

Last packets filtred by chain DROP younger than 2 days :

Chain	Date	Host	Interf.	Proto.	IP	Dest. port
DROP	2002-10-06 21:06:03	nuage	ppp0	UDP	p5082C792.dip0.t-ipconnect.de	137(netbios-ns)
DROP	2002-10-06 21:00:54	nuage	ppp0	UDP	dup-200-65-6-111.prodigy.net.mx	137(netbios-ns)
DROP	2002-10-06 21:00:54	nuage	ppp0	UDP	bgrcvx038228.prexar.com	137(netbios-ns)
DROP	2002-10-06 21:00:37	nuage	ppp0	UDP	host217-39-63-27.in-addr.btopenworld.com	137(netbios-ns)
DROP	2002-10-06 20:58:35	nuage	ppp0	UDP	wkm53-01-p128.fs.saix.net	137(netbios-ns)
DROP	2002-10-06 20:37:57	nuage	ppp0	UDP	200-161-6-88.dsl.telesp.net.br	137(netbios-ns)
DROP	2002-10-06 20:32:53	nuage	ppp0	UDP	211.229.201.148	137(netbios-ns)
DROP	2002-10-06 20:13:15	nuage	ppp0	UDP	N623P014.adsl.highway.telekom.at	137(netbios-ns)
DROP	2002-10-06 20:01:57	nuage	ppp0	UDP	a213-22-193-57.netcabo.pt	137(netbios-ns)
DROP	2002-10-06 19:41:41	nuage	ppp0	UDP	216.6.110.192	137(netbios-ns)
DROP	2002-10-06 19:20:17	nuage	ppp0	UDP	hbt-a17.carrollsweb.com	137(netbios-ns)
DROP	2002-10-06 19:16:36	nuage	ppp0	UDP	async219.starlinx.com	137(netbios-ns)
DROP	2002-10-06 19:05:08	nuage	ppp0	UDP	GR149096.Griffin.PeachNet.EDU	137(netbios-ns)
DROP	2002-10-06 18:57:50	nuage	ppp0	UDP	Ace21.pppool.de	137(netbios-ns)
DROP	2002-10-06 18:54:30	nuage	ppp0	UDP	bds1.66.13.220.210.gte.net	137(netbios-ns)
DROP	2002-10-06 18:46:03	nuage	ppp0	UDP	ANice-101-1-1-106.abo.wanadoo.fr	137(netbios-ns)
DROP	2002-10-06 18:31:25	nuage	ppp0	UDP	pdf7c35.kngwnt01.ap.so-net.ne.jp	137(netbios-ns)
DROP	2002-10-06 18:31:25	nuage	ppp0	UDP	pdf7c35.kngwnt01.ap.so-net.ne.jp	137(netbios-ns)
DROP	2002-10-06 18:28:45	nuage	ppp0	UDP	p3E9E88AD.dip0.t-ipconnect.de	137(netbios-ns)
DROP	2002-10-06 18:28:45	nuage	ppp0	UDP	p3E9E88AD.dip0.t-ipconnect.de	137(netbios-ns)

Records 0 to 20 of 478

Database stats

4587 packets in database
478 packets younger than 2 days
219 packets today
First was at 2002-09-10 03:24:20
Last was at 2002-10-06 21:06:03

Top Hosts [DROP] [2 days]

Host	Nb
80-25-180-170.uc.nombres.ttd.es	54
dup-200-65-245-77.prodigy.net.mx	37
nexus.adsl.nerim.net	36
ABoulogne-107-1-1-216.abo.wanadoo.fr	15
193-153-29-18.uc.nombres.ttd.es	12
pool34-tch-1.Sofia.Orbitel.net	9
AAubervilliers-104-1-4-86.abo.wanadoo.fr	9
montpellier-1-a7-62-147-81-154.dial.proxad.net	8
debian.proxad.net	6
195.24.216.1	6

Top Proto [ALL] [2 days]

Proto	Nb
TCP	252
UDP	226

Top Ports [2 days]

Port	Number	Nb
netbios-ns	137	213
unknown	4662	99
kazaa	1214	95
unknown	4668	13
ms-sql-s	1433	9
ftp	21	8
netbios-ssn	139	7
unknown	6761	7
ident	113	6
unknown	23424	6

Thank You

Questions?